Managing the Oral Sequelae Of Cancer Therapy

Patients undergoing systemic chemotherapy and/or head and neck radiotherapy frequently experience treatment side effects. Oral complications are among the most common problems associated with these therapies. These sequelae include mucositis, oral hemorrhage, infection, and xerostomia (dry mouth). Occasionally, oral complications are so severe that the cancer treatment must be reduced or even terminated. By providing comprehensive care, nurses work to help prevent, identify, and manage these oral sequelae, and thus maximize quality of life. Limiting the effects of oral sequelae increases patient adherence to treatment protocols, improves the quality of life, and increases the odds of long-term survival.

Cancer is one of the most commonly occurring, life-threatening illnesses. Affecting one in two men and one in three women, it is the second leading cause of death in the United States. Every year cancer of the head, neck, and laryngeal regions occurs in an estimated 42,000 people in the United States (American Cancer Society [ACS], 2000).

Most adult-health nurses working in primary care settings are involved with their patients throughout the continuum of health and illness (Martin & Coniglio, 1996). They will often be among the first health care professionals to identify and discuss possible early warning signs of cancer with their patients and are integrally involved in helping patients understand and cope with diagnostic procedures and unwelcome diagnoses. Studies have shown that when patients have their informational needs addressed and their pain controlled, they are much less depressed, have better nutritional status, and can tolerate treatment better than those who do not (Ferber, 1995; Galbraith et al., 1991).

Acknowledgment: The authors wish to acknowledge the assistance of Gerry J. Barker, RDH, MA; Elaine A. Muchmore, MD; Douglas E. Peterson, DMD, PhD; Sol Silverman, MA, DDS; and Robert C. Stoudt, DDS, for their guidance in interpreting the dental literature and concepts upon which this article is based. This article was prepared with the assistance of National Cancer Institute grant number R25 CA65745. Its contents are solely the responsibility of the authors and do not necessarily represent the official beliefs of the National Cancer Institute.
Muchmore, associate director of Table provided by Dr. Elaine *dose-related learning is critical (Sadler et al., 2000). Attention to these issues is limited in nursing school curricula; therefore, self-directed learning is critical (Sadler et al., 2000).

Oral sequelae are among the most common consequences of radiotherapy for head and neck cancers and many of the systemic chemotherapies for cancer (Bellm, Epstein, Rose-Ped, Martin, & Fuchs, 2000; Little, 1996; Sonis et al., 2001). Primary care nurses are in an excellent position to help their patients understand and cope with the oral consequences of impending cancer therapies, recommend appropriate referrals, and initiate health promotion dialogue with their patients. Unfortunately, primary care nurses are inadequately prepared to assume responsibility for this important aspect of patient care (Ohn, Wahlin, & Sjödén, 2000; Sadler, Oberle-Edwards, Farooqi, & Hrynuiuk, 2000). Attention to these issues is limited in nursing school curricula; therefore, self-directed learning is critical (Sadler et al., 2000).

Table 1.
Oral Sequelae of Chemotherapy and Radiotherapy

<table>
<thead>
<tr>
<th>Oral Sequelae</th>
<th>Chemotherapy</th>
<th>Radiotherapy</th>
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<tbody>
<tr>
<td>Xerostomia</td>
<td>X</td>
<td>X</td>
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<td>Mucositis</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Infection</td>
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<td>X</td>
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<tr>
<td>Oral hemorrhage</td>
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<td>X</td>
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<tr>
<td>Radionecrosis</td>
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<td>X</td>
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<tr>
<td>Trismus</td>
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* Table provided by Dr. Elaine Muchmore, associate director of education, UCSD Cancer Center.

This overview of the management of oral sequelae of cancer therapies is offered to assist primary care and other adult-health nurses in guiding their patients through this phase of cancer care. The most common causes of oral sequelae and interventions that can reduce their incidence and severity are discussed. An emphasis is placed on the use of evidence-based interventions whenever possible.

Table 2.
Chemotherapeutic Agent with a High Likelihood of Causing Oral Sequelae

<table>
<thead>
<tr>
<th>Adria*</th>
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<tr>
<td>Ara-c*</td>
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<tr>
<td>5FU</td>
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<tr>
<td>Fludara</td>
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<td>Gemcy</td>
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<td>Topotecan</td>
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<td>Ida</td>
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<tr>
<td>MTX*</td>
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<tr>
<td>Taxol</td>
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*dose-related

Types of Sequelae
Numerous oral sequelae occur due to chemotherapy and radiotherapy (see Tables 1 & 2). These oral sequelae include: exacerbations of chronic oral and dental conditions such as dental abscesses and chronic periodontal disease; xerostomia (commonly referred to as “dry mouth”); mucositis; opportunistic and contagious infections from bacterial, fungal, and viral organisms exacerbated by chemotherapy-induced immune suppression and changes in the oral environment; oral hemorrhage; and radionecrosis.

Consequences of these conditions may include difficulty in achieving optimal nutritional status secondary to dysphagia (difficulty swallowing); odynophagia (painful swallowing); mouth sores; communication problems secondary to pain or dysarthria (difficult and defective speech due to impairment of the tongue or other muscles essential to speech); and severe and irreversible changes such as the loss of teeth and bone. These in turn may lead to decreased patient compliance with continuing recommended cancer treatment (Fox, 1990), medically necessitated decreased dosage/cessation of therapy (Fox, 1990; Graham, Pecoraro, Ventura, & Meyer, 1993; Lockhart & Clark, 1990; Nieweg, van Tinteren, Poelhuis, & Abraham-Inpijn, 1992), prolonged hospital stays with increased costs of care, and delay in the recovery from therapy (Nikoskelainen, 1990; Sonis et al., 2001).

In addition, the failure to assess and adequately monitor the pre-chemotherapy and head and neck radiotherapy treatment status of soft and hard oral tissues and to take appropriate precautions can have profound effects on therapy. Preventing and minimizing the oral sequelae of these cancer therapies will help patients feel better and will increase the odds that the planned course of treatment can be continued without interruption.

Pathophysiology of Oral Sequelae
Chemotherapy and radiotherapy destroy cancer cells at the point of DNA replication. The faster-replicating cancer cells are destroyed at a disproportionately higher rate than normal, healthy cells, thereby minimizing or eliminating the cancer cells more quickly than normal cells (National Cancer Institute, 1999). Other rapidly dividing cells in the body may also be affected, however, including bone marrow, mucosa of the gastrointestinal tract including cells lining the mouth, and hair follicles. As a result, patients receiving chemotherapy often experience partial or total hair loss, GI disturbance, destruction of platelets and red and white blood cells, and oral side effects. The destruction of large numbers of oral mucosal cells can result in mucositis, infection, and oral bleeding. Secondary bacterial insults can further aggravate the ulcerative changes in the oral mucosa (Sonis et al., 1999). These side effects can be exacerbated and their management compromised by patients’ chemotherapy-induced bone marrow suppression.

Nursing Management
Primary care nurses have the strategic advantage of interacting
with patients several weeks to months prior to initiating cancer therapy. This gives them the opportunity to offer anticipatory counseling about the promotion of oral health care at a time when the patient’s oral health has not yet been compromised by the cancer therapy, and there is ample time for oral tissues to heal following any medically necessary dental procedures (Dreizen, Keating, & Beran, 1992; Epstein, 1992).

Pretreatment Preventive Care

To a significant degree, the oral problems associated with cancer therapy can be prevented, minimized, or optimally managed (Karr & Kramer, 1992). A consultation with a dental team experienced in caring for patients undergoing cancer treatment should be completed prior to initiating cancer therapy, and a professional dental prophylaxis (cleaning) should be scheduled (Carl, 1993; DeVita, Hellman, & Rosenberg, 1993; Simon & Roberts, 1991). The nurse can also advocate that the patient, dentist, and radiologist/surgeon/oncologist begin a dialogue concerning the patient’s present and anticipated oral health care needs.

The dental evaluation should focus on identifying pre-existing sites of oral vulnerability and treating those that the oncologist and dentist deem to be medically necessary (Barasch et al., 1993; DeVita et al., 1993; Karthaus, Rosenthal, & Ganser, 1999). Were it not for the impending cancer therapy, many of these services would be considered preventive and hence not covered by the patient’s dental insurance. Instead, they are deemed medically necessary and these services may become eligible for coverage under the patient’s medical and/or dental insurance plan. Early, aggressive treatment, such as the extraction of unsalvageable teeth, the restoration of fractured teeth, and removal of orthodontic bands might be considered medically necessary in advance of cancer therapy.

Teaching patients about the importance of incorporating self-care procedures into their daily routine is also beneficial (Barker, 1999; Galbraith et al., 1991; McGuire et al., 1993). Studies have shown that systematically applied oral hygiene protocols significantly reduce the incidence, severity, and duration of oral sequelae (Grzybowska, Sowinski, Gumieniak, Zieniawa, & Borowski, 1997; Lonnqvist et al., 1993; Turhal, Erdal, & Karacay, 2000). The patient’s self-care procedures should include brushing the teeth using a soft-bristled toothbrush and fluoride toothpaste or gel to help prevent plaque build-up and demineralization of the teeth (Carl, 1993). Patients should also use a sodium chloride (0.9% saline) rinse after brushing, and a fluoride self-treatment once a day. Applying moisturizing cream to the lips is also recommended (Dreizen, Keating, & Beran, 1992). However, the use of Vaseline® and other lip balms that contain petroleum-based compounds should be discouraged, because petroleum is an anhydrous compound that can increase the dryness of the tissues (Barker, Barker, & Gier, 1996). The use of such mouth cleansing aids as commercial alcohol-based mouthwashes or hydrogen peroxide rinses should be discontinued due to their drying and irritating effects on the oral mucosa (DeVita et al., 1993). Nurses can direct patients to toll-free telephone lines and Web site resources for further education and support, plus up-to-the-minute research reports (see Table 3).

Nutritional counseling prior to initiating cancer treatment is imperative (Barker, 1999; Dreizen et al., 1992; Galbraith et al., 1991; McGuire et al., 1993). A well-balanced diet that includes a variety of foods from the five food groups promotes tissue health and healing of damaged tissue and may lessen the severity of oral complications during treatment. The importance of eliminating alcohol and tobacco use prior to, during, and after treatment should be emphasized. Even when the mouth is healthy these substances can dry and irritate the oral tissues and predispose to candidiasis. Their continued use is particularly contraindicated for patients undergoing cancer treatment. In the face of an impending cancer diagnosis, long-term users of these substances may be receptive to a recommendation for permanent termination of their use. This is an optimal time for nurses to counsel patients on the benefits of abstinence and identify appropriate resources and supports.

This pretreatment phase is also a time when primary care nurses can initiate a discussion of the role that clinical research trials play in advancing medical science, including the treatment of cancer and the side effects of both the disease and its treatment (Sadler, Lantz, Fullerton, & Dault, 1999). Special focus can be placed on exploring specific clinical trials that are oriented toward the prevention or management of the oral sequelae of cancer treatment. Many of the clinical trials pertinent to oral sequelae will require collecting pretreatment baseline data and may include randomization to the experimental or control group prior to initiating cancer therapy. For many patients there will be a narrow window of eligibility, making nurses’ referrals all the more critical.

Patients often derive satisfaction from knowing that they are helping to advance the state of knowledge about cancer treatment. Patients participating in oral health clinical trials have the added advantage of receiving care from a second team of experts who are conducting research at the cutting-edge interface between oncology and oral health. Since randomized clinical trials compare the best therapeutic interventions presently available with new treatments that hold the promise of offering equal or better outcomes than standard therapy, patients also have the potential of gaining immediate access to treatment advances that may not otherwise be available for many years. Nurses should alert patients that there are risks and benefits with involvement in research studies and help patients to evaluate the benefits and risks they may face in a particular trial.

Patients may need to be proactive in their search for open oral health/oncology clinical trials. Nurses can help guide their patients to credible sources of
Table 3. Summary of Patient Recommendations

<table>
<thead>
<tr>
<th>Nutritional Consultation</th>
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<tr>
<td>Assess nutritional status and adequacy of dietary intake.</td>
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<tr>
<td>Substitute softer foods for rough/course foods as necessary.</td>
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<tr>
<td>Increase high-moisture foods.</td>
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<tr>
<td>Avoid foods with citric acids as necessary.</td>
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<tr>
<th>Dental/Medical Oral Health Consultation</th>
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<tr>
<td>Schedule dental evaluation of oral health.</td>
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<tr>
<td>Schedule dental prophylaxis.</td>
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<tr>
<td>Fluoride applications in patients anticipated to develop xerostomia.</td>
</tr>
<tr>
<td>Medical/dental consultation to define optimal treatment plan for medically necessary procedures.</td>
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<tr>
<td>Initiate dentist's recommended plan for oral self-care hygiene regimen.</td>
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<tr>
<td>Expand oral hygiene self-care regimen as needed throughout cancer therapy.</td>
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<tr>
<th>Basic Oral Health Self-Care Regimen and Supplies</th>
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<tr>
<td>Extra soft nylon bristle or super soft multifluted toothbrushes.</td>
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<tr>
<td>Biotene® or equivalent toothpaste; avoid toothpastes containing sodium lauryl sulfate.</td>
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<tr>
<td>Flossing supplies by dental advice.</td>
</tr>
<tr>
<td>Mouthwashes that are alcohol free.</td>
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<tr>
<td>Fluoride applications in patients anticipated to receive chemotherapy or radiation therapy:</td>
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<tr>
<td>• 1.1% neutral pH sodium fluoride gel by prescription.</td>
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<tr>
<td>Alcohol-free diphenhydramine.</td>
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<tr>
<td>Water or aloe-based lip balm.</td>
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<tr>
<td>Chlorhexidine rinses by prescription to control dental plaque.</td>
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<tr>
<th>Clinical Interventions</th>
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<tr>
<td>Coating agents: Magnesium aluminum sulfate, Milk of Magnesia®, diphenhydramine syrup.</td>
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<tr>
<td>Analgesics: Aspirin and ibuprofen, Tylenol®, opioids (to be used sparingly, especially in patients at risk for oral hemorrhage); topical preparations such as benzocaine, viscous lidocaine, Hurricaine® (use sparingly, cautiously), or Dyclone.</td>
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<tr>
<td>Lubricating agents: Salagen® by prescription (Evoxac’s patent is pending), ice water, ice cubes, sugar-free popsicles, salivary substitutes (Oral Balance Gel®, Moistir®, UniMist®, or MouthKote®, others), sugarless gum and/or lozenges.</td>
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<tr>
<th>Educational and Clinical Trials Information Resources</th>
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<tr>
<td>National Institute of Dental and Craniofacial Research (NIDCR) and the National Oral Health Information Clearinghouse (NOHIC) (1-877-216-1019) (<a href="http://www.nohic.nidcr.nih.gov/">http://www.nohic.nidcr.nih.gov/</a>)</td>
</tr>
<tr>
<td>National Cancer Institute’s Cancer Information Service (1-800-4-CANCER) (<a href="http://cancernet.nci.nih.gov/">http://cancernet.nci.nih.gov/</a>)</td>
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<tr>
<td>National Library of Medicine (<a href="http://clinicaltrials.gov/">http://clinicaltrials.gov/</a>)</td>
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Information and then help them to evaluate the collected information. Table 3 includes a selection of clinical trials resource sites to help nurses and their patients to find open clinical trials and better understand the roles clinical trials play in advancing medical care.

Nurses can conduct literature searches, either in person or online via NCI’s CancerNet Web site, to identify investigators who are involved in related research as an additional information resource for patients. In addition, the Cancer Information Service can provide a list of all the NCI’s designated cancer centers and the National Institute of Dental and Craniofacial Research (NIDCR) can provide a list of all approved dental schools. Sites that house both a dental school and an NCI-designated cancer center are among those most likely to be engaged in collaborative multidisciplinary research.

During Therapy

Ongoing oral monitoring throughout the therapeutic regimen is critical to help decrease the quantity and severity of side effects. Patients’ oral hygiene regimens should be continued throughout the course of cancer therapy (Barasch et al., 1993; Barker, 1999; DeVita et al., 1993; Galbraith et al., 1991; Grzybowska et al., 1997; McGuire et al., 1993) and they should continue to see their dentist and dental hygienist frequently (Jansma et al., 1992). When a dental team joins forces with the oncology team, the risk of serious oral complications is reduced (Salisbury, 1997; Saral, 1991; Skubitz & Anderson, 1996).

The use of common oral rinses, such as isotonic saline or sodium bicarbonate may help prevent mucositis or reduce the symptoms of xerostomia (Carl, 1993; DeVita et al., 1993; Galbraith et al., 1991). However, there are no confirmatory controlled studies. It has been suggested that the patient begin prophylactic rinses with chlorhexidine to prevent a microbial infection, gum inflammation, and bleeding, and to reduce the risk it caries (Dreizen et al., 1992). While chlorhexidine rinse has beneficial effects on mucositis in some studies, others report negative findings (Dodd et al., 1996; Epstein, Vickars, Spinelli, & Reece, 1992; Ferretti et al., 1990; Foote et al., 1994; Spikervet et al., 1996; Wathlin, 1989; Weisdorf et al., 1989).

The benefits of continued debride ment through regular brushing and flossing should be stressed as a beneficial and preventive procedure because the decreased saliva production can increase the adherence of food particles to the teeth and surrounding tissues. Many patients stop physical procedures and rely entirely on rinses and solutions. Because these do not effectively debride the oral tissues, nurses should encourage patients to continue gentle brushing with a soft toothbrush and regular flossing...
immediately after consuming food or sugar-containing beverages. Regular self-cleansing and professional dental cleaning are among the most beneficial interventions patients can adopt during cancer therapy.

Patients with dentures or orthodontic appliances should be told of the increased risk of complications and discomfort during therapy because radiation and chemotherapy-induced damage to oral cells makes the oral mucosa more easily irritated by prosthetic appliances (Galbraith et al., 1991). This risk increases when dentures are ill fitting or become ill fitting as a result of therapy. Patients may wish to reduce or eliminate their denture use during cancer treatment or at the first sign of oral pathology.

Nutritional counseling should be continued during treatment as well (Barker, 1999; Dreizen et al., 1992; Galbraith et al., 1991; McGuire et al., 1993). Maintaining an adequate caloric intake may be difficult because many cancer therapies cause patients to be nauseated, have a depressed appetite, or experience an alteration in the taste of foods. Patients may experience ageusia (absence, partial loss, or impairment of the sense of taste) or dysgeusia (impairment or perversion of the gustatory sense such that normal tastes are interpreted as being unpleasant or completely different from the characteristic taste of a particular food or chemical compound) (Ganley, 1995; Little, 1996). Nevertheless, maintaining a nutritionally balanced diet is essential to promote the proper healing of the mouth and the body’s other normal tissues that have been compromised by the cancer therapy. Because treatment may dry and inflame the oral tissues, patients may have to learn to bite and chew in different ways to minimize further irritation of the tissues. Treatment can also cause dysphagia (inability to swallow or difficulty swallowing). Foods may need to be prepared in alternative ways. For example, food might be served as a soft puree or liquefied. Alternate foods may need to be substituted for rough or coarse foods. Bread puddings, for example, may be better tolerated as a carbohydrate source than toast, crackers, or cereals. Foods that are acidic should also be avoided because they can dry and/or irritate the tissues.

**Xerostomia**

A common side effect of chemotherapy and radiotherapy is xerostomia, commonly referred to as “dry mouth.” Just as chemotherapy and radiotherapy destroy the rapidly reproducing cancer cells, they can destroy some or all of the cells of the salivary glands. In the absence of saliva, it is easier to injure the oral mucosa and thereby create a possible site of infection. Whereas salivary gland function generally returns to normal after the completion of chemotherapy, function does not usually return after radiotherapy.

Salagen® (pilocarpine hydrochloride) has shown promising effects in increasing salivary flow (Epstein, McBride, Stevenson-Moore, Merilees, & Spinelli, 1991; Hawthorne & Sullivan, 2000; Houston, 1997; Rosenberg, 1990; Singh, Scully, & Joyston-Bechal, 1996; Spijkervet et al., 1990). Unfortunately, it is effective only if the salivary glands have some residual ability to function. Use of pilocarpine prior to treatment appears to increase saliva volume during cancer therapy and, as a result, may improve patient comfort and modulate mucositis. Evoxac® (cevimeline hydrochloride) is another drug that induces salivary flow, but at this time it has been approved only for use in patients with Sjögren’s syndrome, a chronic autoimmune condition that includes dry mouth among its symptoms (Nusair & Rubinow, 1999).

Sugarless gum or lozenges may stimulate salivary secretion in patients with residual salivary gland function (Dreizen et al., 1992; Houston, 1997; Spijkervet et al., 1990). Sugar-free popsicles, plain ice cubes, or ice water may be used to keep the mouth cool and moist (Dreizen et al., 1992). The use of a water or aloe-based lip balm or lipstick can offer comfort by keeping the lips moisturized. Mouthwash helps to keep the mouth clean, but recommended brands should be bland and have no alcohol content, because alcohol can dry the tissues and cause more irritation (Houston, 1997). Eating foods high in ascorbic acid, malic acid, and citric acid will stimulate the glands to increase salivary flow (Karr, Kramer, & Toth, 1992). However, they are not recommended because the acidic quality of such foods can further irritate the tissues, increase patients’ discomfort, and lead to demineralization of the teeth. For the same reason, the use of lemon glycerin swabs to moisturize and clean the oral tissues is not recommended (Houston, 1997; Singh et al., 1996; Spijkervet et al., 1990). Because lemon glycerin is also anhydrous, it will further aggravate xerostomia and dental demineralization. Although sweets and chewing gum can increase salivary flow, they are not recommended because of their high sucrose content that increases the likelihood of dental demineralization and caries. Sugar-free alternatives may offer some relief.

With mouth or throat cancer, the area is often irradiated to such an extent that the salivary glands are no longer capable of secretion (DeVita et al., 1993). To prevent dental caries and dental demineralization, patients should apply fluoride gel daily using custom-fit trays. This should be done during and after radiotherapy to minimize the damaging effects of radiation on the salivary glands (Barker et al., 1996). Because damage to the salivary glands is irreversible, gel use must become a lifelong practice.

Some substances may help to increase the production of natural saliva. However, an optimal substitute for saliva for use when glands have been completely damaged, has not been discovered. Artificial salivas, such as UniMist®, Mouth Kote®, and Oral Balance Gel®, although “poor salivary substitutes,” may provide patients some relief (Furumoto, Barker, Carter-Hanson, & Barker, 1998; Houston, 1997; Spijkervet et al., 1990). Comparative trials of a number of mouthwetting agents found Biotene
Mucositis

Characterized by inflammation and ulceration of the oral mucosa, mucositis is the single most significant complication reported by patients due to radiation and chemotherapy (Bellm et al., 2000). Patients may also experience discomfort and pain of mucositis as a side effect of chemotherapy and/or radiotherapy. Maintaining a self-care regimen decreases the incidence of mucositis from 44% to less than 26% (Barker, 1999; Ferber, 1995; Grzybowska et al., 1997). While many products, such as combined product rinses, have been suggested for clinical use, few have been studied in randomized controlled trials and should therefore be used with caution. Combination of rinses may allow some products to interfere with the action of others, and the compounding may result in dilution of the individual rinse’s levels that may not be effective.

The discomfort of the mucositis can be reduced with coating agents, topical anesthetics, and analgesics (Carl, 1993; Carl & Emrich, 1991; Epstein et al., 1991; Spijkervet et al., 1990). Magnesium aluminum sulfate, Milk of Magnesia\(^a\) (magnesium hydroxide), and diphenhydramine have all been suggested as good coating agents for the oral mucosa. A 50:50 solution of nonalcoholic diphenhydramine syrup and either magnesium aluminum sulfate or Milk of Magnesia is a suggested mouthwash. The diphenhydramine reduces the inflammation while the antacid coat the mouth (Carl, 1993; Dreizen et al., 1992; Spijkervet et al., 1990).

A number of factors should be considered regarding mouthrinse selection. If the patient is swallowing the rinses that contain diphenhydramine, the maximum daily dose indicated on the package should not be exceeded. Topical anesthetics, particularly in rinse form, may result in intense, but short-term anesthesia that can increase aspiration risk. In addition, they may be absorbed systematically and can trigger cardiac effects. Topical anesthetics, such as benzocaine, viscous lidocaine, Hurricaine\(^b\), or Dyclone\(^b\) can be applied with a swab or a soft vinyl mouth guard (Carl, 1993; DeVita et al., 1993; Dreizen et al., 1992; Spijkervet et al., 1990). Sucralfate suspension may be helpful in treating oral pain (Barker et al., 1996; Epstein & Scully, 1991). A three-way comparison between salt and soda mouthwashes; mouthwashes made of lidocaine, diphenhydramine, and Maalox\(^b\); and mouthwashes of 0.12% chlorhexidine gluconate found that all three options were equally effective in treating mucositis (Dodd et al., 2000). As mentioned earlier, chlorhexidine rinse may have some beneficial effects. Benzydamine hydrochloride is not yet available in the United States, but has shown some promise in reducing inflammation and pain (Turnbull, 1995).

The least costly and easiest mouthwash for patients to prepare comprises a teaspoon of salt and a teaspoon of baking soda (sodium bicarbonate) in eight ounces of water (Dodd et al., 2000). Analgesics that contain aspirin and ibuprofen should be used with caution as they may increase the risk of oral bleeding (Devita et al., 1993). Sucking on sugar-free popsicles and ice chips or drinking cold, sugar-free beverages can help numb the area and thereby help relieve pain (Laga, Toth, Rolston, & Tarrand, 1993).

**The most important thing patients can do to decrease the risk of excessive oral bleeding is to continue their prescribed oral hygiene regimen.**

Oral Hemorrhage

Oral hemorrhage is discouraging for patients coping with cancer. The most important thing patients can do to decrease the risk of excessive oral bleeding is to continue their prescribed oral hygiene regimen. A program of daily care can decrease gingivitis and the risk of gingival bleeding (Epstein et al., 1991; Grzybowska et al., 1997; Singh et al., 1996; Spijkervet et al., 1990). Although some bleeding of the gums is common during oral hygiene in patients undergoing cancer therapy, excessive bleeding is not normal and should be brought to the oncologist’s attention promptly. Avoiding alcohol-based oral rinses, hot liquids, smoking, eating hard or rough foods, and other irritating factors can also be beneficial (Epstein et al., 1991).

Decreased platelet production secondary to chemotherapy places patients at a higher risk of oral bleeding. In the most severe cases of decreased platelet production, a platelet transfusion may be necessary (Epstein et al., 1991; Singh et al., 1996; Spijkervet et al., 1990). If the patient is at high risk for oral bleeding and is known to have poor oral hygiene, mucositis, and/or gingivitis, fibrin sealant systems can be used as a mode of prevention. The fibrin sealant is applied directly to sites with a high potential for bleeding (Epstein et al., 1991).

When oral bleeding does occur, contrary to earlier recommendations (DeVita et al., 1993), the use of a vinyl mouth guard lined with Vaseline-saturated gauze is no longer advised due to the anhydrous nature of the petroleum-based Vaseline (Barker et al., 1996). Oral cooling with ice chips and pressure should be considered. If it is desirable to use a mucosal coating agent, then a water-based substance, such as Surgilube\(^b\), is preferable for soaking the gauze. Applying pressure

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\(^a\)Oral Balance® to be superior to other agents (Epstein, Emerton, Le, & Stevenson-Moore, 1999; Haveman & Redding, 1998; Regelink, Vissink, Reintsema, & Nauta, 1998). Many patients rely upon ice chips and water for mouth wetting, and can carry water bottles with them throughout the day. If mouth irritation becomes painful, the patient can be given an antihistamine such as diphenhydramine to relieve the associated discomfort (Holmes, 1988).

\(^b\)Mucositis

Characterized by inflammation and ulceration of the oral mucosa, mucositis is the single most significant complication reported by patients due to radiation and chemotherapy (Bellm et al., 2000). Patients may also experience discomfort and pain of mucositis as a side effect of chemotherapy and/or radiotherapy. Maintaining a self-care regimen decreases the incidence of mucositis from 44% to less than 26% (Barker, 1999; Ferber, 1995; Grzybowska et al., 1997). While many products, such as combined product rinses, have been suggested for clinical use, few have been studied in randomized controlled trials and should therefore be used with caution. Combination of rinses may allow some products to interfere with the action of others, and the compounding may result in dilution of the individual rinse’s levels that may not be effective.

The discomfort of the mucositis can be reduced with coating agents, topical anesthetics, and analgesics (Carl, 1993; Carl & Emrich, 1991; Epstein et al., 1991; Spijkervet et al., 1990). Magnesium aluminum sulfate, Milk of Magnesia\(^a\) (magnesium hydroxide), and diphenhydramine have all been suggested as good coating agents for the oral mucosa. A 50:50 solution of nonalcoholic diphenhydramine syrup and either magnesium aluminum sulfate or Milk of Magnesia is a suggested mouthwash. The diphenhydramine reduces the inflammation while the antacid coat the mouth (Carl, 1993; Dreizen et al., 1992; Spijkervet et al., 1990).

A number of factors should be considered regarding mouthrinse selection. If the patient is swallowing the rinses that contain diphenhydramine, the maximum daily dose indicated on the package should not be exceeded. Topical anesthetics, particularly in rinse form, may result in intense, but short-term anesthesia that can increase aspiration risk. In addition, they may be absorbed systematically and can trigger cardiac effects. Topical anesthetics, such as benzocaine, viscous lidocaine, Hurricaine\(^b\), or Dyclone\(^b\) can be applied with a swab or a soft vinyl mouth guard (Carl, 1993; DeVita et al., 1993; Dreizen et al., 1992; Spijkervet et al., 1990). Sucralfate suspension may be helpful in treating oral pain (Barker et al., 1996; Epstein & Scully, 1991). A three-way comparison between salt and soda mouthwashes; mouthwashes made of lidocaine, diphenhydramine, and Maalox\(^b\); and mouthwashes of 0.12% chlorhexidine gluconate found that all three options were equally effective in treating mucositis (Dodd et al., 2000). As mentioned earlier, chlorhexidine rinse may have some beneficial effects. Benzydamine hydrochloride is not yet available in the United States, but has shown some promise in reducing inflammation and pain (Turnbull, 1995).

The least costly and easiest mouthwash for patients to prepare comprises a teaspoon of salt and a teaspoon of baking soda (sodium bicarbonate) in eight ounces of water (Dodd et al., 2000). Analgesics that contain aspirin and ibuprofen should be used with caution as they may increase the risk of oral bleeding (Devita et al., 1993). Sucking on sugar-free popsicles and ice chips or drinking cold, sugar-free beverages can help numb the area and thereby help relieve pain (Laga, Toth, Rolston, & Tarrand, 1993).

**The most important thing patients can do to decrease the risk of excessive oral bleeding is to continue their prescribed oral hygiene regimen.**

Oral Hemorrhage

Oral hemorrhage is discouraging for patients coping with cancer. The most important thing patients can do to decrease the risk of excessive oral bleeding is to continue their prescribed oral hygiene regimen. A program of daily care can decrease gingivitis and the risk of gingival bleeding (Epstein et al., 1991; Grzybowska et al., 1997; Singh et al., 1996; Spijkervet et al., 1990). Although some bleeding of the gums is common during oral hygiene in patients undergoing cancer therapy, excessive bleeding is not normal and should be brought to the oncologist’s attention promptly. Avoiding alcohol-based oral rinses, hot liquids, smoking, eating hard or rough foods, and other irritating factors can also be beneficial (Epstein et al., 1991).

Decreased platelet production secondary to chemotherapy places patients at a higher risk of oral bleeding. In the most severe cases of decreased platelet production, a platelet transfusion may be necessary (Epstein et al., 1991; Singh et al., 1996; Spijkervet et al., 1990). If the patient is at high risk for oral bleeding and is known to have poor oral hygiene, mucositis, and/or gingivitis, fibrin sealant systems can be used as a mode of prevention. The fibrin sealant is applied directly to sites with a high potential for bleeding (Epstein et al., 1991).

When oral bleeding does occur, contrary to earlier recommendations (DeVita et al., 1993), the use of a vinyl mouth guard lined with Vaseline-saturated gauze is no longer advised due to the anhydrous nature of the petroleum-based Vaseline (Barker et al., 1996). Oral cooling with ice chips and pressure should be considered. If it is desirable to use a mucosal coating agent, then a water-based substance, such as Surgilube\(^b\), is preferable for soaking the gauze. Applying pressure
with gauze at the site of the bleeding will help (Epstein, 1992). The use of soft vinyl mouth guards for protection can also be used against further injuries (DeVita et al., 1993; Epstein et al., 1991). Pressure can be applied by using a periodontal dressing applied to the site of bleeding. Should bleeding persist, the application of hemostatic agents such as epsilon amino caproic acid, thanexamic acid, microfibrillar collagen, or topical thrombin has been helpful (Epstein, 1992; Epstein et al., 1991; Rosenberg, 1990).

Infection

Patients with chemotherapy-suppressed immune function will have a compromised ability to fight infection. When patients develop an oral pathology such as mucositis, xerostomia, oral bleeding, or other mouth sores, the health care provider’s primary concern will be preventing local and systemic infections. Treating these infections as soon as they are detected will help to reduce localized pain and the spread of infection. A culture is recommended if an infection is suspected. Recommendations for the use of prophylactic oral rinses and medications will be specific to the identified organism.

Nystatin rinses are the most widely recommended treatment for the onset of fungal infections such as oral candidiasis (thrush), despite a lack of proven efficacy in intensive chemotherapy and transplant patients (Barker, 1999; DeVita et al., 1993; Epstein, 1990; Galbraith et al., 1991; Houston, 1997; Singh et al., 1996; Spijkervet et al., 1990). Compliance is also a concern because nystatin has an unpleasant flavor and may cause nausea and vomiting (Ferber, 1995). Therefore, the usefulness of nystatin in chemotherapy or bone marrow transplant patients may be limited (Epstein, 1992). In patients treated with head and neck radiotherapy, candida colonizaton increases throughout the course of treatment and remains elevated if xerostomia occurs (Epstein, 1992; Ramirez-Amador, Silverman, Mayer, Tyler, & Quivey, 1997). Topical antifungals such as clotrimazole, ketoconazole, and chlorhexidine, which may suppress the organism. For more severe infections, the use of a systemic antifungal medication such as Fungizone® (amphotericin B) is recommended (Carl, 1993; Epstein, 1990; Epstein, 1992; Simon & Roberts, 1991; Singh et al., 1996).

Systemic amphotericin B must be used with caution, however, due to its potential for liver toxicity (Epstein, 1992; Simon & Roberts, 1991). Studies have shown that amphotericin B is more effective as a topical agent (Epstein, 1992; Epstein et al., 1991; Spijkervet et al., 1990). The use of such agents as GM-CSF (granulocyte-macrophage colony-stimulating factor) and G-CSF (granulocyte colony-stimulating factor) to stimulate an increased production of white blood cells is also effective in fighting fungal infections (Bodey, Anaissie, Gutterman, & Vadhan-Raj, 1993), but because this is an expensive treatment, it may not be an option for all patients.

Peridex® (0.12% chlorhexidine gluconate) is an antimicrobial rinse with both antifungal and antibacterial properties. In one study, chlorhexidine was no more helpful than placebo in reducing the severity and incidence of infection (Dodd et al., 1996). Its tendency to stain teeth and its alcohol content can further irritate inflamed tissues (Barasch et al., 1993; Carl & Emrich, 1991; Epstein et al., 1991; Epstein & Scully, 1991; Ferber, 1995; Saral, 1991). If chlorhexidine is used, nystatin and chlorhexidine should not be used at the same time because chlorhexidine tends to bind nystatin and render it ineffective (Epstein et al., 1991; Ferber, 1995). Since chlorhexidine is generally unstable in the presence of other agents, it should be used at least 30 minutes before or after the use of any other agents.

The use of an oral rinse containing hydrogen peroxide (Carl & Emrich, 1991) is not advisable. It is irritating to the oral mucosa and can cause further discomfort. Bland, nonalcohol-based antibacterial mouthwashes are better choices. Topical antibacterial medications can also be recommended to treat infections (Epstein, 1992); however, topical antibacterial medications can lead to a shift in the oral microflora and have the potential to encourage fungal involvement or the growth of antibiotic-resistant strains of bacteria (DeVita et al., 1993). Topical antiseptic agents can be considered.

For viral infections, such as herpes simplex 1, acyclovir is recommended for both prophylaxis and treatment (Carl, 1993; Dreizen et al., 1992; Epstein et al., 1991; Epstein, Sherlock, & Wolber, 1993; Levy-Polack, Sebelli, & Polack, 1998; Singh et al., 1996; Spijkervet et al., 1990). Denavir® ( penclovir), a newer antiviral medication, is also available. Foscarnet should be used when an acyclovir-resistant strain of herpes simplex virus has been detected (Epstein et al., 1993).

Following Therapy

When chemotherapy has been completed and the blood counts have returned to normal, oral complications usually begin to resolve. Patients should continue to follow a self-care regimen to keep the teeth and gums healthy and facilitate the repair of any residual oral damage (Barker, 1999). Teeth should be brushed (2 to 4 times a day) and flossed (once daily), foods sweetened with sucrose should be avoided, and a neutral pH fluoride gel should be applied to the teeth (Saral, 1991). Saline and/or bicarbonate rinses should be continued until the mouth has completely healed (Galbraith et al., 1991; Saral, 1991). It is crucial that patients continue to devote attention to maintaining optimal nutrition regimen. Because it may take time for the tissues to heal completely, patients may benefit from the maintenance of some or all of the dietary modifications they used during their cancer treatment.

Long-term management and close followup of patients after radiation therapy are mandatory because many chronic complications occur, including xerostomia, mucosal sensitivity, dental caries, candidiasis, and persisting risk of osteonecrosis. Consequences of radiotherapy to the oral cavity also include trismus (decreased jaw
mobility secondary to fibrosis of the muscles of mastication) and osteoradionecrosis (devitalized bone). An interdisciplinary team of nurse, physical therapist, and dentist can work collaboratively to assist patients to resolve trismus through a variety of oral isometric exercises. In its most severe form, trismus will require oral reconstructive interventions (Cremoese, Bryden, & Bottcher, 2000; Whitmeyer, Waskowski, & Iffland, 1997).

**Summary**

According to the NIDCR (1990), almost one-third of all cancer patients undergoing radiation, chemotherapy treatment, and/or bone marrow transplants are at risk for oral complications that may compromise or even cause cessation of treatment. To address this issue, NIDCR has launched a campaign to promote oral health awareness prior to and during cancer treatment. The campaign is designed to reduce and better manage the oral sequelae that often arise in cancer patients and to promote interdisciplinary collaboration among health care providers to achieve those goals. A cancer treatment team should include oncologists, dentists, nurses, dental hygienists, nutritionists, and other appropriate therapists who are knowledgeable in the sequelae of cancer therapy and oral health maintenance and able to work collaboratively to treat their patients holistically.

Primary care nurses play an important role in promoting optimal quality and quantity of life for patients with cancer. Although patients will normally see a specialty team during treatment, PCNs are uniquely positioned to offer anticipatory and ongoing counseling and support. Guiding patients through the complex steps of diagnosis, referral, and treatment, including the possibility of participation in clinical trials, is critical. Health team collaboration will significantly enhance the quality of care and long-term outcomes for patients who are at risk of experiencing the oral sequelae of cancer therapy.

**References**


